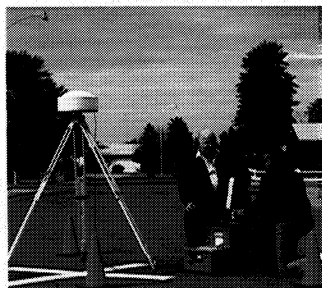


At right, Chuck Muncy and Werner Brutsch of Sunrise Geodetic Surveys, Mesa, Arizona, are setting up their equipment for a town survey. Their equipment, however, differs from conventional surveying systems that employ transit, rod and chain to measure angles and distances. They are using the ISTAC Model 2002 positioning system, which offers fast, accurate surveying with exceptional orders of accuracy, obtained by processing signals from orbiting satellites.

Below, and at right, Sunrise employees are surveying a remote area for placement of microwave towers. This illustrates a particular advantage of the ISTAC Model 2002. In mountainous terrain or in areas of dense vegetation, the surveying team would normally have a long and difficult job clearing the line of sight pathways between two siting points that are essential for operating conventional systems. The 70-pound ISTAC system can easily be backpacked or helicopter-transported into remote locations and its only requirement is a line of sight to the sky. Satellite-referenced position-



ing data is stored on site in a portable data recorder and later downloaded into the office computer for analysis (far right).

The ISTAC Model 2002 is manufactured by ISTAC, Inc., Pasadena, California, and sold or leased to surveying companies. It is based on technology developed by California Institute of Technology's Jet Propulsion Laboratory under NASA sponsorship. Inventor of the technology was Peter MacDoran, now president of ISTAC.

Working on a way to provide highly precise measurements of Earth's crust for tectonic studies and earthquake prediction, MacDoran conceived SERIES, a package consisting of satellite receiving hardware and signal processing software that produces positioning data with accuracies as fine as five centimeters (two inches). MacDoran was subsequently granted a NASA waiver assigning him commercial rights to the technology. He formed ISTAC to develop the technology further and

adapt it as a surveying tool using reference signals from the U.S. Air Force Navstar Global Positioning System (GPS).

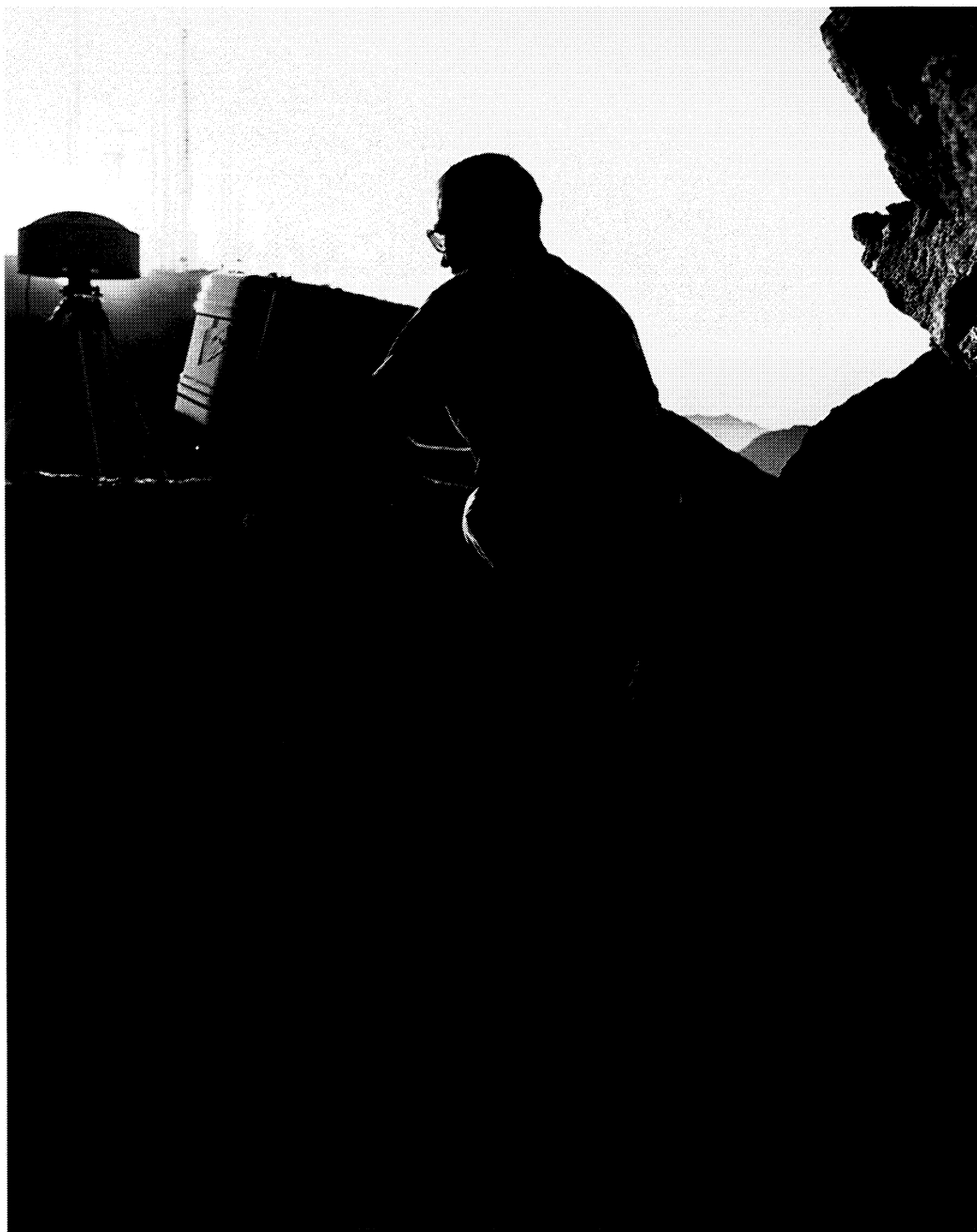
The Navstar GPS is a network of navigation satellites intended to provide superaccurate position fixes for military aircraft, ships or land vehicles anywhere on Earth. It is currently operating as an interim, part-time Block I system for testing and user familiarization; civilians are authorized to use the Block I system.

Beginning next year, the USAF will begin to replace the Block I satellites with more advanced Block II Navstars in what will ultimately be a 21-satellite constellation. However, the advent of Block II will pose a problem for civilian users. The Block II Navstars will send signals on two channels, the superaccurate Precise Positioning Service (PPS) and a

less accurate Standard Positioning Service (SPS). For reasons of military security, PPS signals will be encrypted and the code will not be available to civilian users except by special approval of the Department of Defense. The SPS channel will be available to civil users, but its accuracy will be intentionally degraded.

The special utility of the ISTAC Model 2002 is that it can provide positioning of the highest accuracy from Navstar PPS signals because it requires no knowledge of the secret codes. It operates by comparing the frequency and time phase of a Navstar signal arriving at one ISTAC receiver with the reception of the same set of signals by another receiver. The data is computer processed and translated into three dimensional position data—latitude, longitude and elevation. This technique does not





compromise military security and is, in fact, welcomed as a viable means of civil use of the GPS.

The ability of ISTAC Model 2002 and other codeless receivers to use the military network opens up a broad range of civil applications. ISTAC Model 2002 is used by a number of surveying firms in the U.S. and the United Kingdom for city surveys, construction surveys, and geodetic surveying.

A future application (when 24-hour global satellite coverage is available), is seismic surveying for exploration of hydrocarbon resources. ISTAC receivers—one on the seismic ship, one on a trailing buoy and one on land—can acquire position data from four different Navstar satellites; positioning computations are handled by a computer aboard the seismic vessel. ▲

